N71-24205

NASA SP-5919 (01)

TECHNOLOGY UTILIZATION

GRAPHIC ARTS TECHNIQUES AND EQUIPMENT

A COMPILATION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA SP-5919 (01)

GRAPHIC ARTS TECHNIQUES AND EQUIPMENT

A COMPILATION

TECHNOLOGY UTILIZATION OFFICE 1970
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D.C.

For sale by the National Technical Information Service, Springfield, Virginia 22151 – Price $1.00

Foreword

The National Aeronautics and Space Administration has established a Technology Utilization Program for the rapid dissemination of information on technological developments which have potential utility outside the aerospace community. By encouraging multiple application of the results of its research and development, NASA earns for the public an increased return on the investment in aerospace research and development programs.

In this compilation, summary descriptions of a variety of graphic arts techniques and equipment, are presented in one volume. It is felt that these techniques and devices will aid their users in faster production at no sacrifice in quality and, in some instances, noticeable improvement in product quality. No claim is made for novelty in these techniques and devices, but all are believed useful and practical.

Additional technical information on individual devices and techniques can be requested by circling the appropriate number on the Reader's Service Card included in this compilation.

Unless otherwise stated, NASA contemplates no patent action on the Technology described.

We appreciate comment by readers and welcome hearing about the relevance and utility of the information in this compilation.

Ronald J. Philips, *Director*
Technology Utilization Office
National Aeronautics and Space Administration

Contents

SECTION 1. Drafting Aids

Page

SECTION 2. Visual Aids

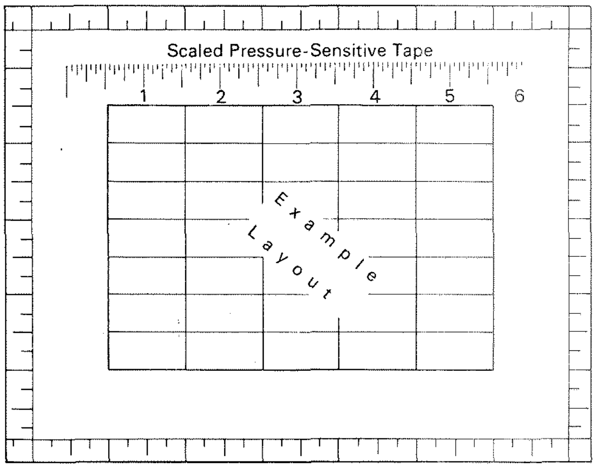
Section 1. Drafting Aids

SCALED PRESSURE-SENSITIVE TAPE

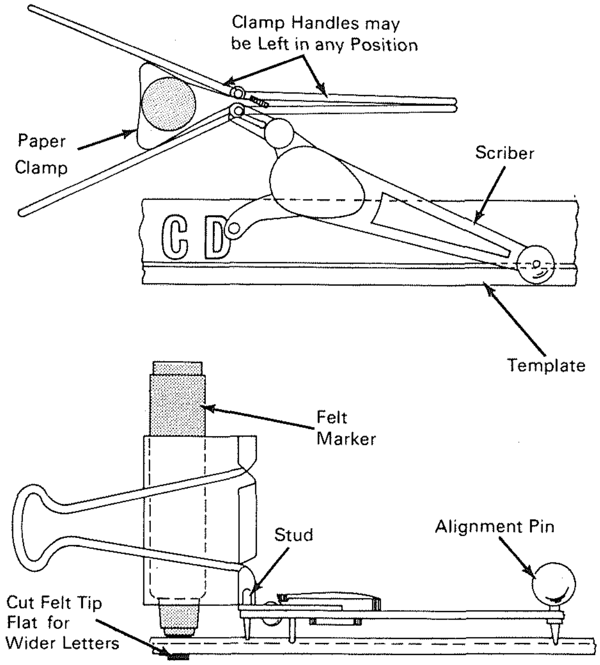
Laying out, plotting, or updating large display charts with ordinary straight edges, carpenter's rules, tape measures, and the like are time-consuming practices that generally lack accuracy. A solution has been found in the application of either architectural or engineering scale imprinted on transparent pressure-sensitive tape. The scaled tape may then be applied along the borders of the charts or to any desired portion of the working surface.

Source: W. J. Wittbold of
The Boeing Company
under contract to
Kennedy Space Center
(KSC-10137)

No further documentation is available.



LETTERING SET ADAPTER FOR COLOR WORK



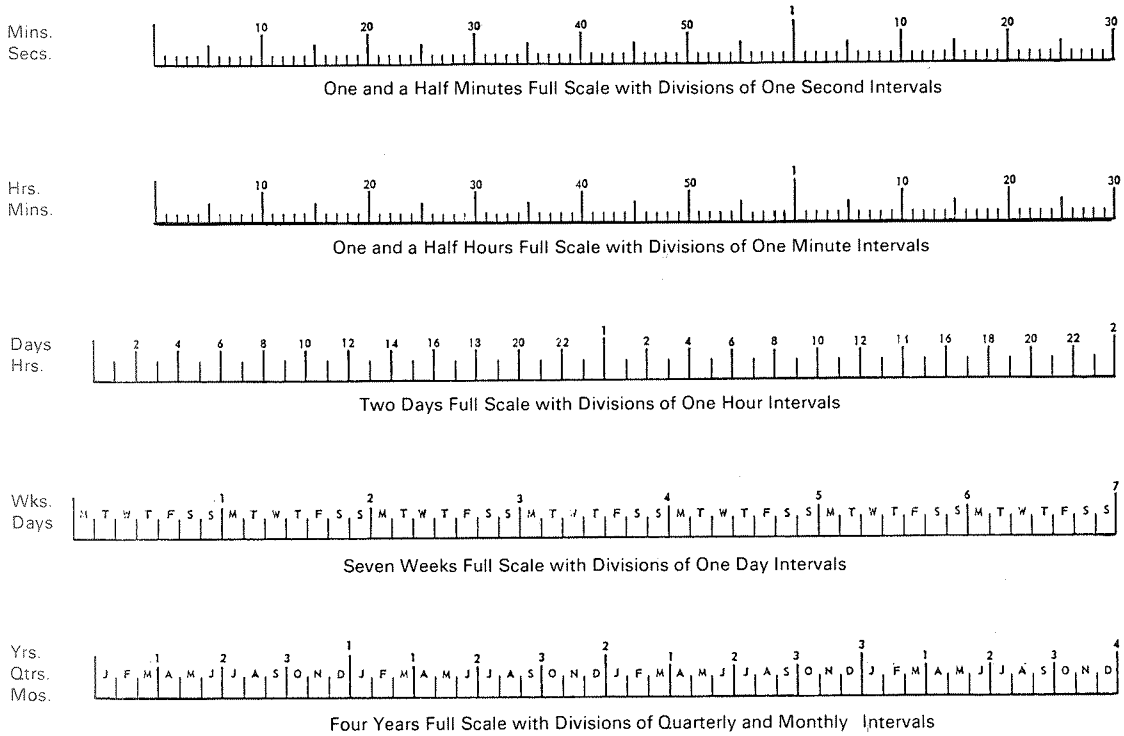
In flip charts used to assist an oral presentation, it is often advantageous to use different colors and line weights. In order to produce consistently neat work and a variety of colors, an adapter has been made that enables a precision lettering scriber to be used with felt-tipped brush pens.

A standard office-type paper clamp and small stud are all that is required to make the adapter. One handle is removed from the paper clamp and the stud is press fitted into the opening and the handle then replaced. The free end of the stud is pushed into the opening of the scriber which normally holds the scribing pen point, and the setscrew secures it firmly. The clamp is opened sufficiently to insert the felt marker and the unit is ready for use.

Source: Elmer H. Bergton of
The Boeing Company
under contract to
Kennedy Space Center
(KSC-10352)

No further documentation is available.

PLOTTING TIME-ORIENTED DATA



Common Time Unit Scales Used with 10 Grids per Inch Graph Paper or Plane Paper

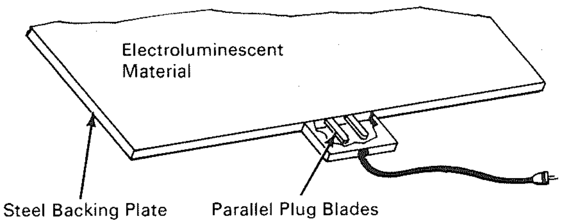
Construction of scales for plotting significant events on graphs and charts with respect to time is a time-consuming task where existing rules or scales are not to appropriate dimensions. Five scales have been developed with 10 grids per inch and five with 10 grids per centimeter. The illustration shows the inch scales. These scales can be used to evenly dimension any length axis.

With the scale acting as the hypotenuse of a right triangle and the line to be dimensioned acting as the bottom leg, the points can be marked on the hypotenuse and lines perpendicular to the bottom axis drawn through each marked point and the bottom axis. Intersection of the perpendicular lines evenly divides the bottom axis into the desired dimensions. The scales are reproduced by photography and may be used to layout time-oriented data directly.

Source: James S. Taylor of
The Boeing Company
under contract to
Kennedy Space Center
(KSC-10298)

Circle 1 on Reader's Service Card.

FLAT SURFACE CONVERTED TO LIGHT TABLE



A technique has been developed that converts any flat surface (drawing board, table top, desk top) to a useful light table. The conversion consists of a coating of electroluminescent material placed on a steel backing plate and covered with a transparent ceramic material. Parallel plug blades, one contacting the electroluminescent material and

the other contacting the backing plate, are attached to a power cord which can be plugged into a conventional electrical outlet. The bottom and ends of the backing plate are coated with an elastomeric insulating material. This device has been made in prototype and successfully operated on a standard drafting table, with use of the drafting table straightedge unhindered.

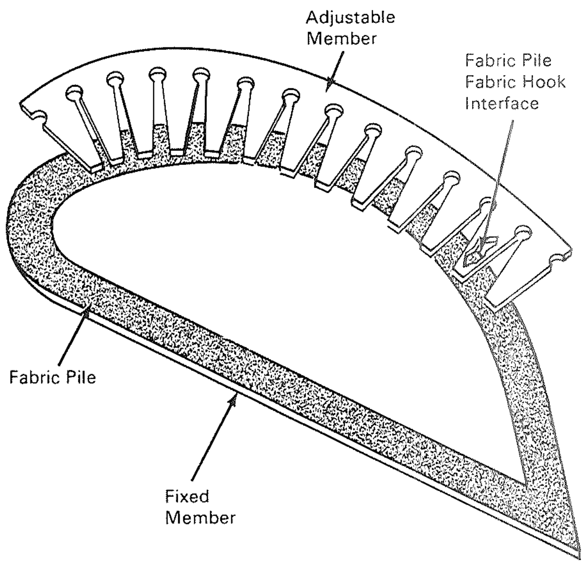
Source: Robert T. Wilson of
The Boeing Company
under contract to
Kennedy Space Center
(KSC-10296)

Circle 2 on Reader's Service Card.

ADJUSTABLE TEMPLATE

In drawing angles and fairing curves, draftsmen and illustrators have to use a large number of drafting tools or adjustable, flexible tools that depend on mechanical links such as screws and hinges. These are awkward to handle. Pattern makers and model builders have difficulty in using such tools to transfer curve planes from prints to work pieces. An adjustable template has been designed and constructed that uses a well known principle to permit easy and rapid curve and angle changes over a relatively wide range.

As shown in the illustration, the template consists of a fixed member and an adjustable member. One member is faced with a fabric pile, and the other with fabric in a "hook design". When the two fabric faces are pressed together, they hold firmly against any reasonable lateral force. Cutouts in the adjustable member permit its flexure to the desired contour, at which point it is interfaced with and pressed against the rigid fixed member. The pile face and "hook" face interlock and retain the adjustable member in the selected contour while the curve is transferred to the drawing. The two members can then be readily separated by a "peeling" motion, pulling each away from the other.



Source: Penn G. Harriss of
The Boeing Company
under contract to
Marshall Space Flight Center
(MFS-15024)

Circle 3 on Reader's Service Card.

MATRIX, GRID, AND TABLE GENERATOR

Production of a great variety of matrix originals and copies can be made using transparent grid masters. There is no need to draw a master for each different configuration. Every organization requiring forms can use this process. It has broad, general application in graphics, technical illustrating and art, commercial design, engineering drafting, and public advertising. The process is of special interest to firms with limited supplies and storage space.

The generator masters are transparent plastic sheets, half marked with horizontal lines and half with vertical lines. Placing a horizontal master over a vertical master and xeroxing yields any number

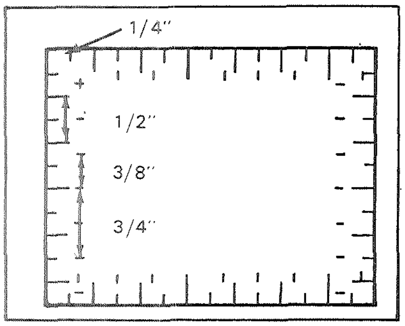


Figure 1

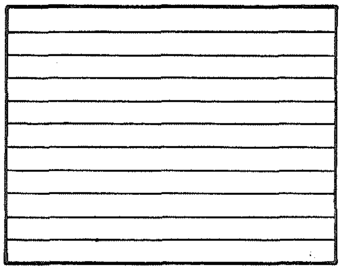


Figure 2

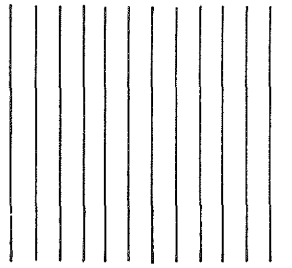


Figure 3

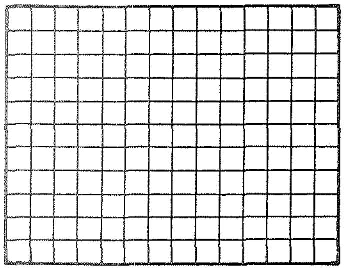


Figure 4

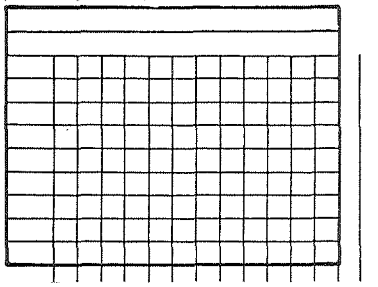


Figure 5

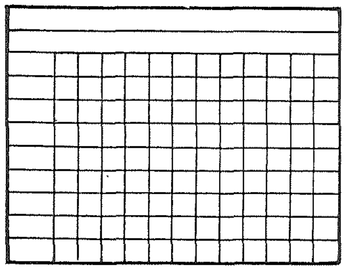


Figure 6

of required copies. Many designs can be produced by simple combinations of predesigned masters.

Making a matrix generator is straightforward. First, a matrix is drawn on bond paper within an image area which allows room on the paper for titles, punching for binding, and marking to include all increments needed, as shown in Figure 1. One-eighth inch increments may be satisfactory. On an 8-1/2 × 11 inch sheet, a suggested image area is approximately 6 × 7-3/4 inches. Next, translucent vellums are placed over this matrix, and each increment is traced on a different vellum. The heavier image area, however, is drawn only on the sheets with horizontal lines, as shown in Figure 2. Vellums with vertical lines, depicted in Figure 3, are drawn so that the ends of the lines can be concealed by the heavier image area when printed, as shown in Figure 4. After completion of drafting, all vellums are reproduced on transparent film. A small register mark is made on each vellum to insure that the location of the image area is identical on each sheet.

One transparency with horizontal lines and another with vertical lines of the required increments are selected, and the combination of transparencies is xeroxed and reproduced in any quantity (Figure 4). Since the transparent originals are kept for future use, no secondary masters or copies need be saved.

To increase the number of variable matrixes possible with this method, another step yielding a great variety of combinations may be taken. A horizontal transparency is placed over a vertical one; the vertical lines are shifted to the right and downward to create various formats which can be used for writing, dating, etc., as illustrated in Figure 5; and xerox reproductions are made. The extra vertical lines are masked out on this second master with strips of paper, paint, or tape. Then all copies needed are reproduced (Figure 6) from the second master, which can be filed for future use.

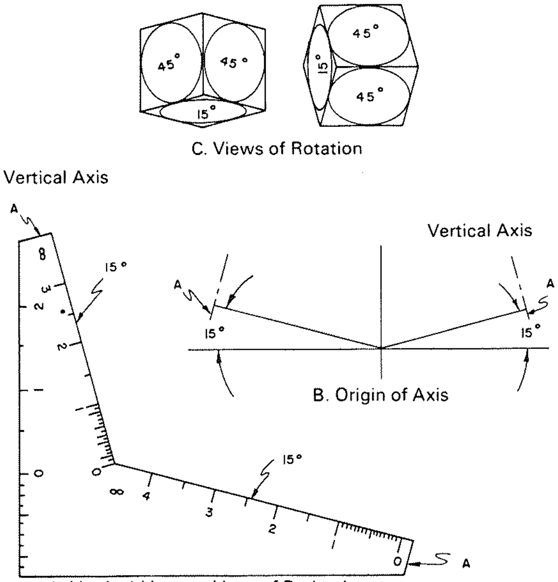
Commercially available opaque adhesive-coated tape of various widths may be affixed temporarily to the transparent masters to emphasize lines, form columns, or separate specific areas. The tape may be removed after duplication.

Use of the transparent masters for making a great variety of secondary masters and copies is advantageous. It practically eliminates the need for drafting any standard grid or matrix within the range of the increments used and, because of the rapidity with which any variables may be set up and reproduced, reduces the need for filing stacks of masters and copies.

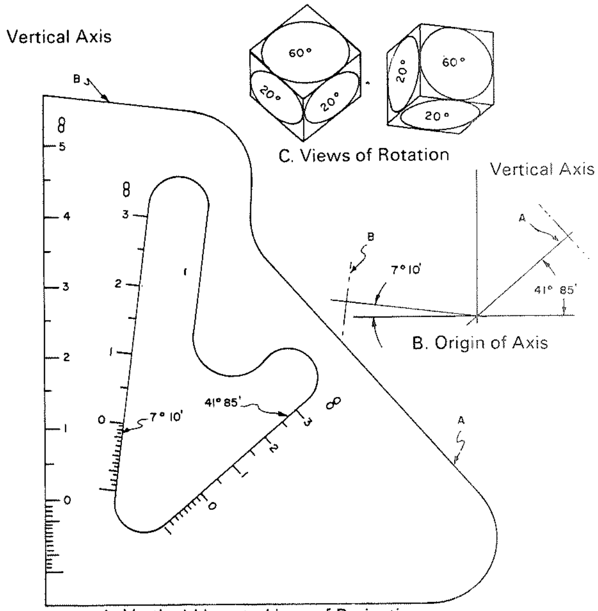
Source: H. E. Burgess of
General Electric Company
under contract to
NASA Headquarters
(HQN-10372)

Circle 4 on Reader's Service Card.

AXONOMETRIC ANGLE AIDS



A. Vertical Lines to Lines of Projection
Figure 1: Dimetric Aid 15°



A. Vertical Lines to Lines of Projection
Figure 2: Dimetric Aid

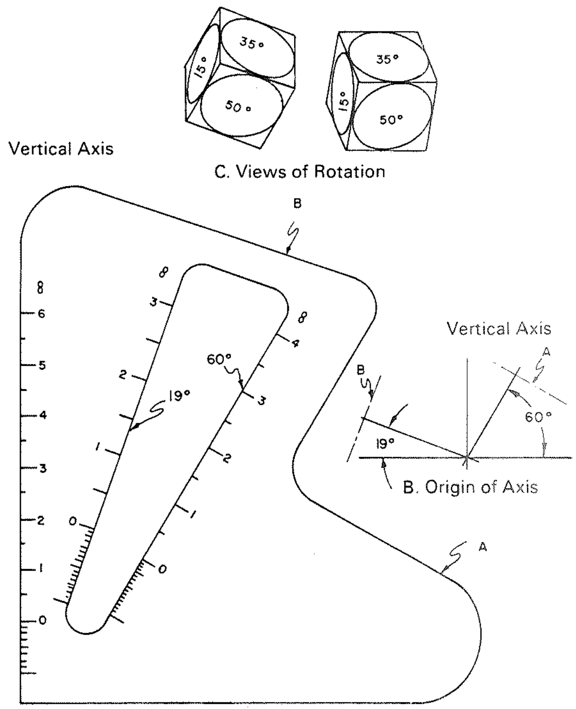
Three axonometric angle aids (templates) eliminate the need for calculations and triangulations when a draftsman illustrates multiview projections. The templates provide foreshortened scales to predetermine distances for each axonometric axis, provide vertical lines to the line of projection, allow for four views per template by rotation around the vertical axis, and provide for dimensional accuracy of all views.

Figure 1 is a dimetric aid with 15° receding axes, upon which foreshortened scales are engraved. The projection obtained is 15°-45°. Figure 2 is a dimetric aid with 7° 10′ and 41° 85′ receding axes with foreshortened scales. The projection obtained is 20°-60°. Figure 3 is a trimetric aid with 19° and 60° receding axes with foreshortened scales. The projection obtained is 15° -35° -50°.

Section A of each figure shows the vertical lines of projection; B shows the origin of the axis; and C illustrates sample views of rotation possible with each template.

Source: James C. Ryan of
North American Rockwell Corp.
under contract to
Manned Spacecraft Center
(MSC-90953)

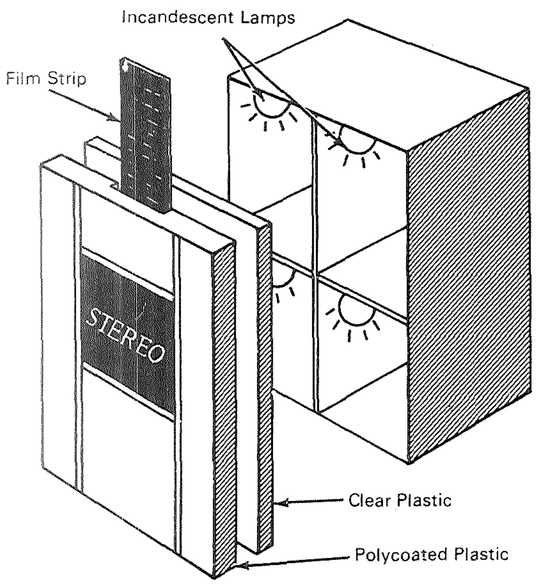
No further documentation is available.



A. Vertical Lines to Lines of Projection
Figure 3: Trimetric Aid

Section 2. Visual Aids

ILLUMINATED DISPLAY PANEL IS EASILY CHANGED



Illuminated, multicolored display panels that are flexible, inexpensive, easily changed, and readily fabricated at the point of use have been developed.

A photographic negative with information transparent and background opaque black is placed between two sheets of plastic and back-lighted in selected areas.

The display panel consists of a plastic film holder and a backlighting structure. An outer polycoated (front surface frosted) plastic sheet and inner clear plastic sheet are held securely in a metal frame but sufficiently separated to permit the insertion of a filmstrip. The backlighting structure is a matrix of one-inch squares, each containing a small incandescent lamp. Control of the lamps permits selective lighting of these areas to fit the display in use. Color may be incorporated in a display by backing the negative with transparent colored tape in any desired variety. A plain or multicolored display can be fashioned by this method in about five minutes using current speed-camera techniques to produce the film negative.

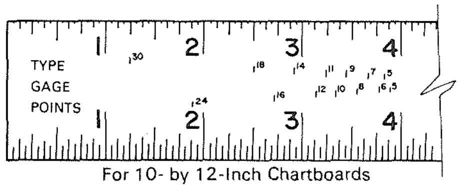
Source: International Business Machines
under contract to
Manned Spacecraft Center
(MSC-90108)

Circle 5 on Reader's Service Card.

SCALES FOR BRIEFING CHARTS

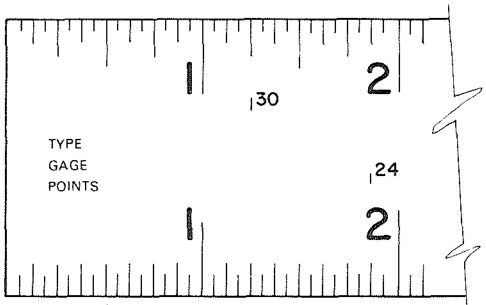
A fast and efficient method has been found for determining proportional reductions of strip-ins for briefing charts, thereby eliminating proportion scales and mathematical computing.

On oversize briefing chart pasteups, frisket material provides a clear window into which halftone negatives may be stripped following reduction and screening. To determine the size of the strip-in windows, the original chartboard frisket can be measured and the reduced size computed from a proportion scale; however, this allows possible errors. Another method requires direct measurement of the strip-in window from the reduced chart negative, and application of these measurements to the reduction of the halftone. This is a time-consuming technique.



With the new method, one step is needed to determine the reduction required on the originals to fit the strip-in windows. Briefing chart pasteups usually are made in two sizes, so two scales

have been constructed for direct measurement. The photoenlarged, direct-reading scales were produced for 20- by 30-inch and 10- by 12-inch



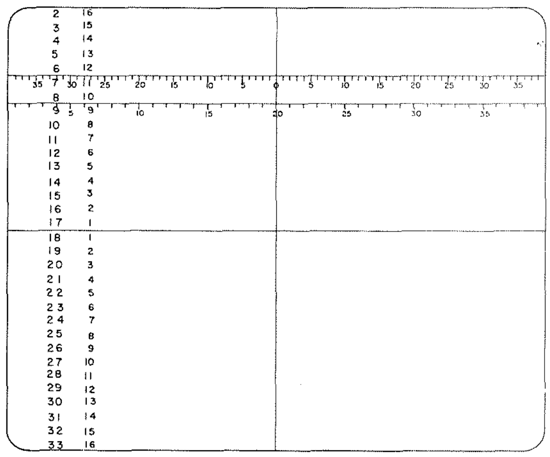
For 20- by 30-Inch Chartboards

pasteups. Using these scales, one can determine what size the window will be after reduction and the size that will be required for the strip-in to fit the window. The dimensions permit halftone production and chartboard reduction to be performed simultaneously on different cameras, thereby reducing total chart production time.

Source: Robert E. Rhoads of
North American Rockwell Corp.
under contract to
Marshall Space Flight Center
(MFS-13135)

Circle 6 on Reader's Service Card.

OVERHEAD BRIEFING CHART FORMS



Briefing charts for overhead projection can be typed quicker and more accurately by using a standard vellum typing form which proportionately scales the finished 18-point typewritten format down to a standard 10-point typewriter size.

Formerly, when material was submitted for briefing charts in rough copy or typed on a standard typewriter, the submitter had no idea of the data limitations or size parameters of the final chart. The new standard chart forms eliminate the differences in material placement between the rough drafts and the final copy.

The standard format for 10-point lettering typewriters is used by the person preparing the rough draft. Preprinted guide lines allow layout, spacing, and centering to be performed on the rough draft. The final briefing chart is then made by typing the information, which appears on the rough draft, on the enlarged image format sheets designed for 18-point lettering. The layout, spacing, and centering are thus built into the system.

Source: Edwin A. Hird of
North American Rockwell Corp.
under contract to
Manned Spacecraft Center
(MSC-90453)

No further documentation is available.

CHARACTER-INDICATING DISPLAY DEVICE

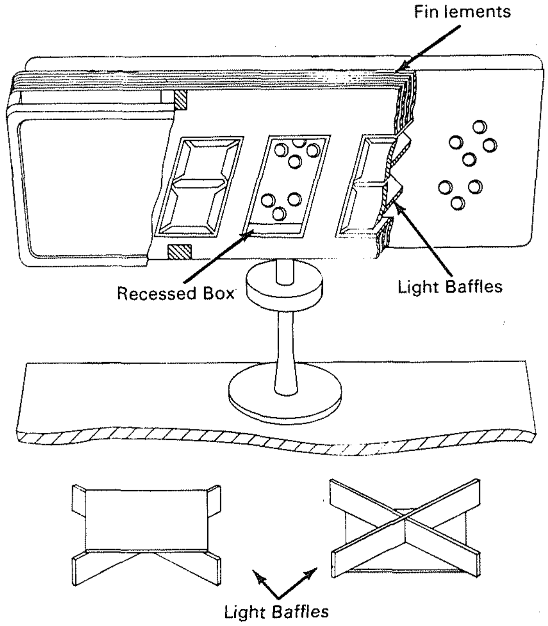
A digital display device has been designed to present individual characters reflecting changing data in rapid sequence to large groups of viewers. Such a device could be used to advantage in displaying transportation information in terminals, scoreboard data for sporting events, and traffic control information.

This display has a maximum luminosity that is uniform, producing no bright spots, and the digits displayed are easily read in virtually any environment, regardless of light reflection. Each digit is displayed by means of a box recessed in the body of the device. This box has a reflective coating on its back wall. Projecting into each box are seven

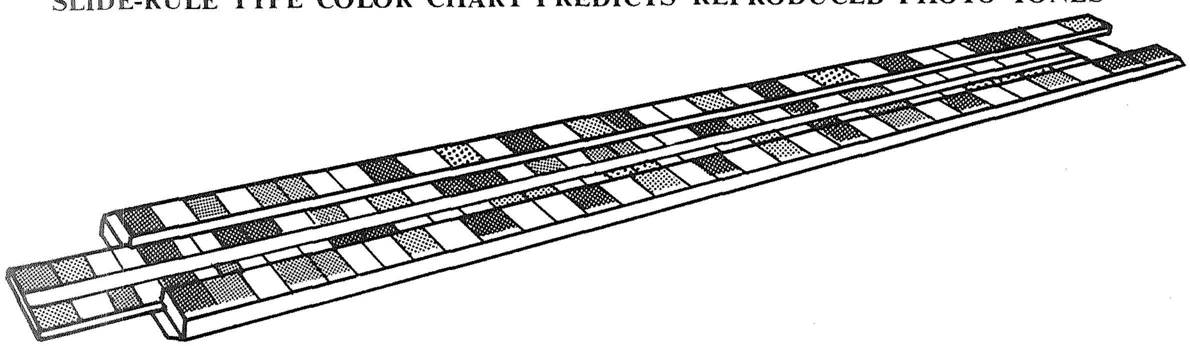
incandescent light bulbs, four in the top and three in the bottom. Light baffles, with dimensions smaller than the box, are placed in front of the two sets of bulbs. Crossed members form an "X" behind and constitute a part of each baffle. They create pockets that contain the light from the individual bulbs, forming one portion of each digit displayed. The baffles are positioned to prevent direct viewing of the bulb elements. They can be made big enough to provide large illuminated segments of each digit by increasing the space between the side of the baffle and the box. Internal construction of the device provides baffles and a slot that afford heat dissipation by convection cooling through a chimney-like effect.

Source: Craydon A. Phlieger of
Kennedy Space Center
(KSC-09983)

Circle 7 on Reader's Service Card.



SLIDE-RULE TYPE COLOR CHART PREDICTS REPRODUCED PHOTO TONES



In the production of briefing charts that are photographed in black and white, it is necessary to determine the final reproduced gray tones in order to achieve a pleasing and effective contrast as between superior and subordinate chart increments.

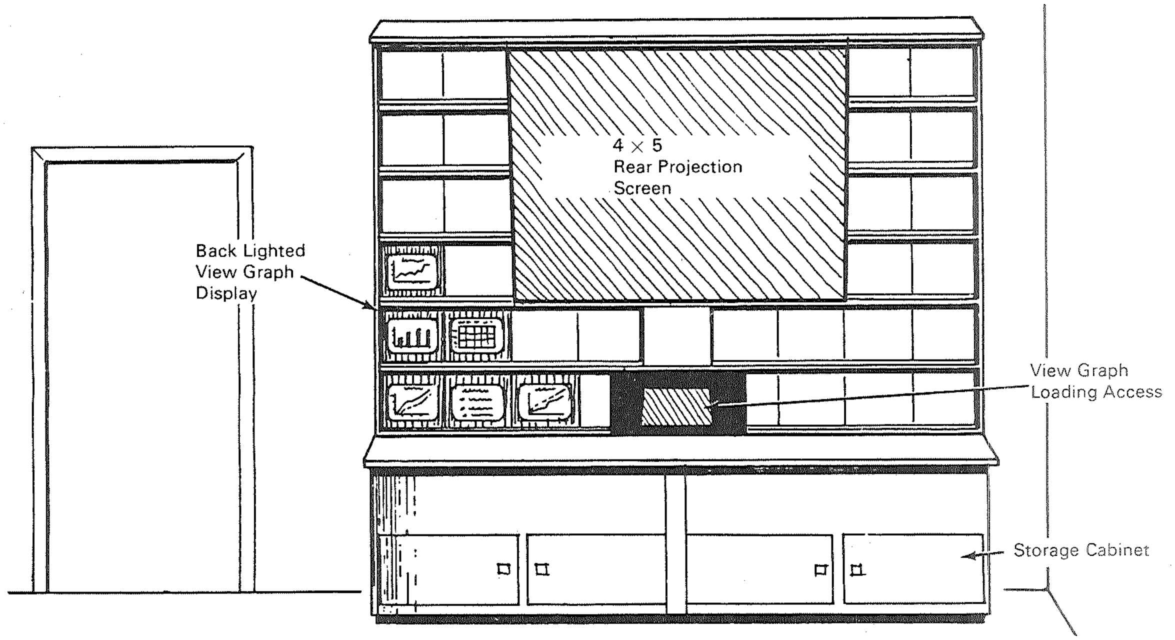
This is accomplished by using a slide rule type color chart that shows both the color by drafting paint manufacturer's name and mixture number, and by the gray tone resulting from black and white photographic reproduction.

The selection of colors necessary to produce sufficiently contrasting gray tones is made quickly and easily by moving the rule slide and visually comparing the various gray tones as they register adjacently. As the desired contrast is determined, the appropriate color identification by manufacturer's names and hues is read from the rule. The names and corresponding hues of the various manufacturers appear on the rule above and below the various gray tones. This rule should be useful for commercial artists to assist in selecting specific colors to produce desired photographic tone contrast.

Source: J. D. Griffin of
North American Rockwell Corp.
under contract to
Manned Spacecraft Center
(MSC-91227)

Circle 8 on Reader's Service Card.

TRANSPARENCY PRESENTATION PROGRAMMER



A system has been devised with which a speaker can project a series of 8 x 10 inch transparencies on a rear-lighted 4 x 5 foot screen. This system allows the speaker to work alone, thus eliminating the communication problems that can arise when the services of a projectionist are required.

The transparencies are mounted on cardboard frames in the normal manner and placed in slotted shelves adjacent to the projection screen. The backs of the shelves are of polycoated glass that passes sufficient light to make the mounted transparencies visible, while not detracting from the image on the screen. The programmer is operated from the front by the speaker, who faces his audience and places the transparencies on the projector through the loading access.

With this system, an informal speaker/audience atmosphere is created, no seating capacity is lost in the meeting area, and there is immediate access to any transparency at any time.

Source: John M. Johnson, Jr. of
The Boeing Company
under contract to
Kennedy Space Center
(KSC-10189)

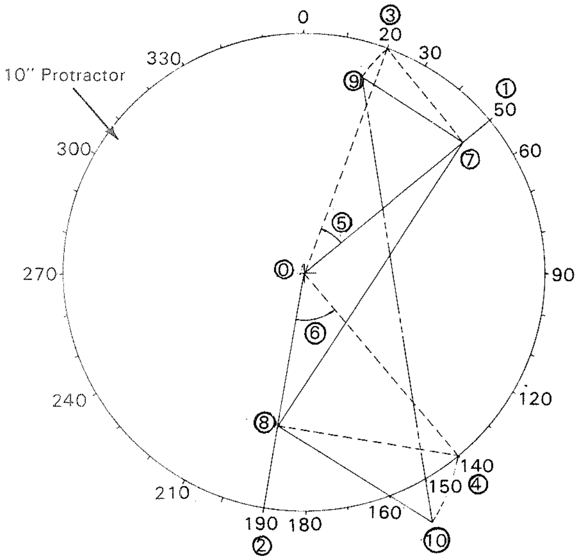
Circle 9 on Reader's Service Card.

GRAPHIC METHOD OF DETERMINING ANGLES BETWEEN VECTORS

To find the angle between two spatial unit vectors, one may use vector algebra, spherical trigonometry, or a graphic method. While the graphic method is merely a complement to the other two techniques, it is useful where tables and other computational aids are not available.

On the sketch, zero on the protractor scale is considered the Greenwich meridian, and vectors are defined using spherical coordinates by giving the Greenwich Hour Angle (GHA) and Declination (D) of each and considering the plane of the paper as the equatorial plane. Assume vector 1 has a GHA of 50° and a D of 30°N, while vector 2 has a GHA of 190° and a D of 50°S. For vector 1, a line is drawn from the origin O (center) to the 50° mark on the periphery, and an arc length corresponding to a D of 30°N is laid out (see point 3 or angle 5). Similarly, for vector 2, a line is drawn to the 190° mark, and an arc length corresponding to a D of 50°S is laid out (see point 4 or angle 6). Perpendi-

cular projections are now dropped from points 3 and 4 to points 7 and 8 respectively. The lengths 0, 7 and 0, 8 are the true lengths of the projections

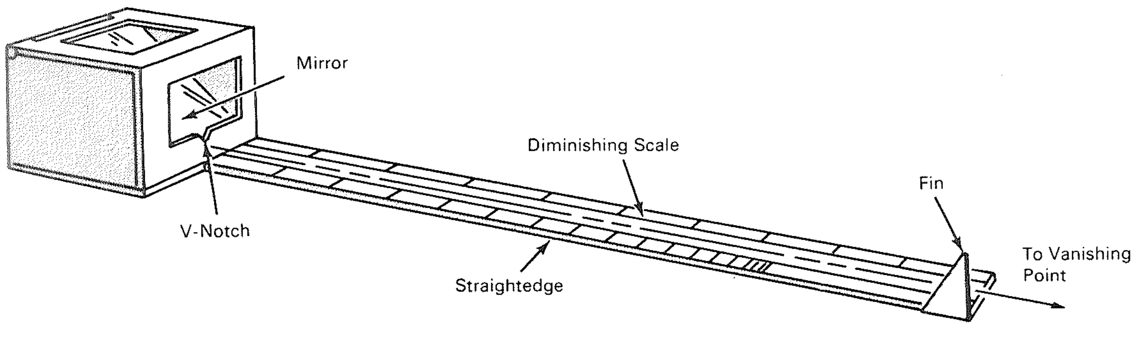


onto the equatorial plane of vectors 1 and 2 respectively. A line is drawn from point 7 to point 8, and its length is the true distance between the terminal points of vectors 1 and 2 projected onto the equatorial plane. Two perpendiculars are drawn from line 7, 8: one from 7 to 9 and the other from 8 to 10. The length 7, 9 is the same as length 7, 3 as indicated by the construction arc; and length 8, 10 is, similarly, equal to length 8, 4. Note that the line 7, 9 has been laid out above line 7, 8, corresponding to a northerly or positive declination, whereas line 8, 10 is below line 7, 8, corresponding to a sourtherly declination. This is somewhat arbitrary so long as opposite sides of line 7, 8 are used to account for the sign of the declination. The final construction is the line from 9 to 10. The distance 9, 10 is the true chord length between the terminal points of vectors 1 and 2. The angle between the two vectors is measured by placing the protractor on line 9, 10 and measuring the arc length (or angle) corresponding to the chord length.

Source: R. E. Strelow of
North American Rockwell Corp.
under contract to
Manned Spacecraft Center
(MSC-11920)

No further documentation is available.

INSTRUMENT TRANSMITS VANISHING POINT TO ILLUSTRATION POINT



It is frequently necessary to transmit the vanishing point of an illustration to a particular point on the illustration when drawing two- and three-point perspective. In large work, especially, the vanishing point will be at an appreciable distance from the illustration. Commercially available aids, such as perspective grids and boards, are not satisfactory for such work. An instrument that transmits the vanishing point to a point on a diminishing scale and also serves as a straightedge has been developed.

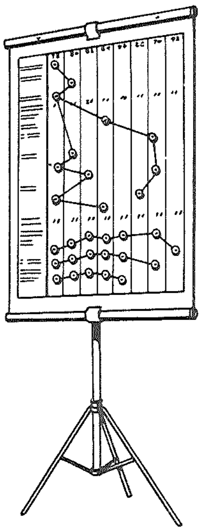
A mirror, mounted at a 45° angle is mounted in a housing with a window in its top and another in one of its sides. The top window is used for sighting into the mirror, through the side window, that has a V-notch in its bottom center, along the diminishing scale to a sighting fin mounted on the end of the scale. By aligning the

selected vanishing point with the sighting fin and center of the V-notch, the vanishing point is transmitted to a point on the diminishing scale. The diminishing scale is used both as a straightedge and foreshortening medium, its drawing edge being aligned with the V-notch and sighting fin. The housing is hinged in a manner to facilitate cleaning of the mirror.

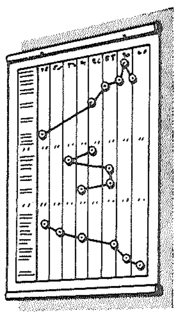
Source: Manuel M. Alvarez of North American Rockwell Corp. under contract to Manned Spacecraft Center (MSC-90267)

Circle 10 on Reader's Service Card.

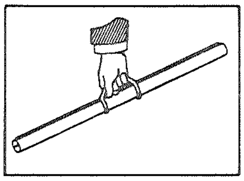
FLEXIBLE MAGNETIC PLANNING BOARDS ARE EASILY TRANSPORTED



Stand Mounted



Wall Mounted



Hand Carried

A compact, easily transportable planning board has been designed for use with magnetic display devices. Both preprinted boards and those on which a person can write are useful.

Several configurations of the portable magnetic planning board are possible. For applications where a preprinted board is desired, a clear plastic coating may be bonded to a 0.005-inch steel sheet. This provides a flexible magnetic sheet which is then printed. A simpler and less expensive board can be made from close mesh steel screen. This type of magnetic board is excellent for use under paper charts.

These planning boards can be wall mounted, stand mounted, or placed on hinged display panels. For transporting, they need only be rolled up and hand carried. Magnetic planning boards can be used with small magnets or commercially available magnetic display material.

Source: General Dynamics/Astronautics under contract to Marshall Space Flight Center (MFS-90340)

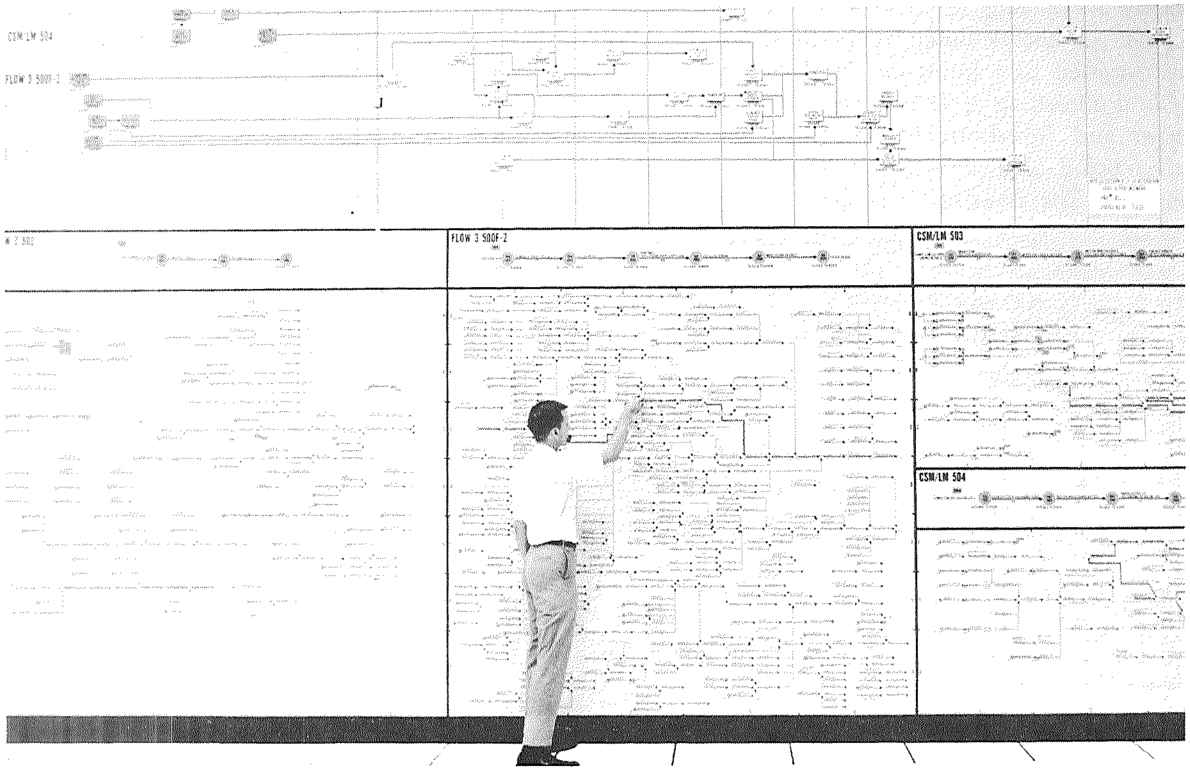
No further documentation is available.

DISPLAY BOARD CHANGE SYSTEM

Updating large, complex program activity display board or PERT (Program Evaluation and Review Technique) networks is a tedious and time-consuming task that must be accomplished without error. When a display board must reflect the status of a major program daily, the updating process is a continuous operation that requires the close coordination of numerous inputs.

A system has been developed to change large displays or PERT networks rapidly, in order to reflect the current status of a program within a few hours. First, the display board is divided up into a grid network. A master file of every function on the board is then generated, listing each function by number and by grid coordinates, thus enabling the user to quickly locate any function. Magnetized plastic symbols, lines, and markings in the form of "off-the-shelf" items that are available in a wide variety of shapes, sizes, and colors are used for coding purposes. When a change is made, the required magnetic symbols are acquired and the change is quickly and easily accomplished by replacing the old symbols with the new.

An additional aid in speeding up the changes is the division of the display into a number of workable sections, with each section being handled as

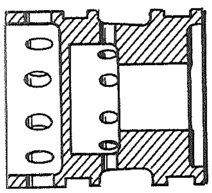


a separate entity. Changes are indicated (redlined) on a current drawing of the section, and a kit of the required symbols is assembled. One person, working from the redlined drawing, calls out the changes to be made by function number and grid coordinates. Another person, working with the symbol kit for that section, makes the physical changes on the display board. Each section is changed in like manner until all sections have been changed.

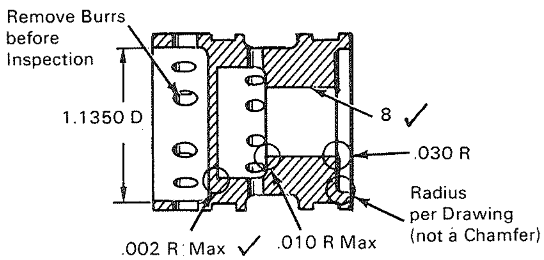
Source: Paul H. Drake of
The Boeing Company
under contract to
Kennedy Space Center
(KSC-10191)

Circle 11 on Reader's Service Card.

OVERLAY CLARIFIES CRITICAL DRAWING AREAS



Basic Illustration of Part



Overlay Superimposed Over Basic Illustration

In operating shop machinery such as drills, shapers, milling machines etc., the operator must be guided by engineering drawings which often do not have detail sufficient to draw his attention to problem areas. This results in a high incidence of rework or scrapping of production items. A

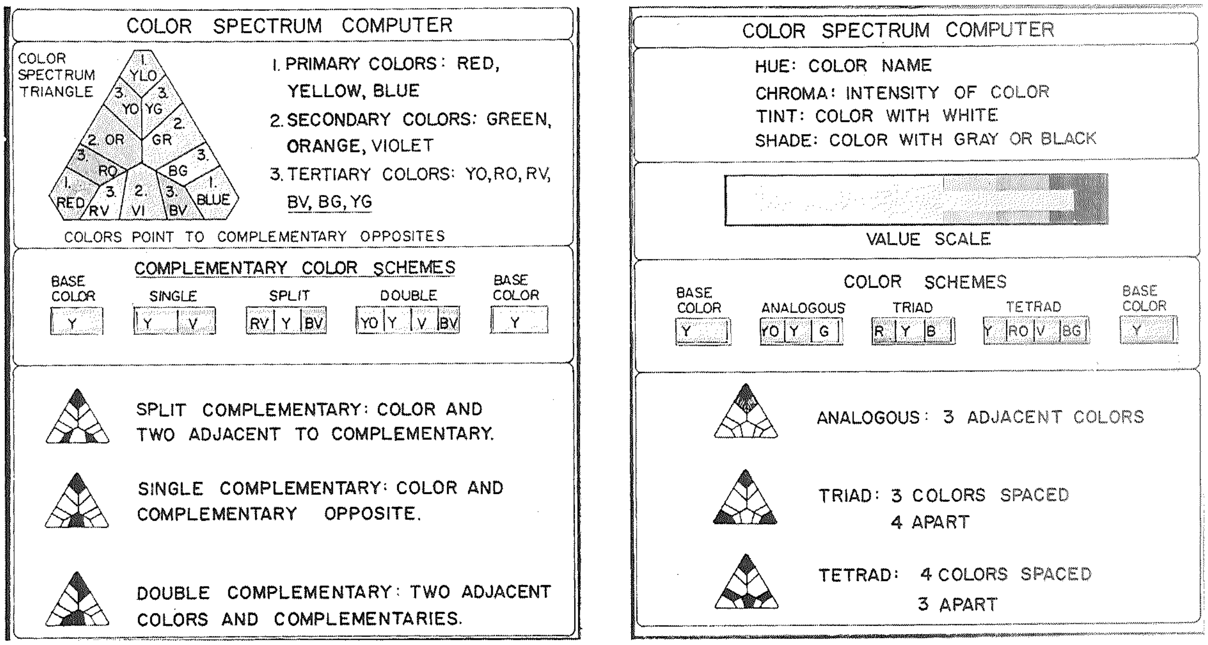
scheme has been devised that calls the operator's attention vividly to the problem areas.

Flip charts are mounted on an easel and placed by the machine in full view of the operator. These charts feature heavy inked lines that illustrate the parts and their dimensions. An overlay of mylar is prepared with appropriate entries of critical dimensions, surface finishes, and other particularly troublesome details. It is made to flip over the basic drawing, thus bringing the troublesome details into registry with the basic. Black is normally used on the mylar, but colors may be used for greater accent.

Source: W. W. Dick of
North American Rockwell Corp.
under contract to
Marshall Space Flight Center
(MFS-14256)

Circle 12 on Reader's Service Card.

COLOR SPECTRUM COMPUTER



A pocket-size, hand-held computer has been fabricated that enables the user to rapidly determine color hues through the complete range of primary, secondary, and tertiary colors. This quick-reference selector should prove valuable to persons involved in the selection and/or blending of paints, printing inks, etc., because it eliminates the time-consuming step of extrapolation that is required when using the conventional "color wheel." The human error factor is thus avoided. In addition, quick determination of complementary colors can be made at a glance.

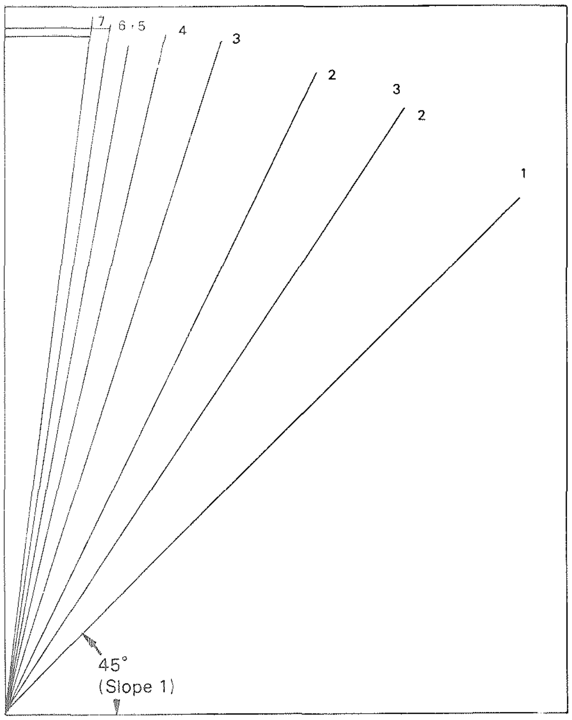
The illustration shows both sides of this "slide-rule" type color spectrum computer. With the computer slide set for the color of interest, all pertinent color information (hue, chroma, tint, shade, and complementaries) is shown through the windows on both sides of the computer. Tertiary and complementary colors are readily discernible by reading the proper slide rule heading and by observing the data displayed in the windows. Color-blind persons with basic color combination knowledge could use this technique.

Source: Eugene J. Carroll of
North American Rockwell Corp.
under contract to
Marshall Space Flight Center
(MFS-16702)

Circle 13 on Reader's Service Card.

TEMPLATE AIDS IN DATA REDUCTION

A transparent template makes possible rapid determination of exponents of power functions plotted on log-log paper. The man-hours required for data reduction are greatly decreased, because exponential values can be determined by simple inspection.



The value of the exponent of a parameter is determined from the slope of a straight line drawn through the plotted data points. The plastic template is especially applicable to expedite determination in cases where the data contain some scatter. The template is a rectangular sheet upon which are scribed a number of straight lines radiating from a common origin. These lines have slopes of 1:1, 2:1, 3:1, etc., to any desired value. The exponent value is readily determined by placing the template on the log-log plot.

The template has been used for the reduction of data of ionization and luminosity as a function of velocity and could be used by any engineer with similar data reduction problems.

Source: C. N. Scully of
North American Rockwell Corp.
under contract to
Manned Spacecraft Center
(MSC-90824)

Circle 14 on Reader's Service Card.

ANALYTICAL DRAFTING CURVES PROVIDE EXACT EQUATIONS FOR PLOTTED DATA

Exact equations for plotted data can be provided by using analytical drafting curves, each having a reference coordinate axis system indicated on the curve, as well as the mathematical equation from which the curve was generated.

Given a set of data points that have been plotted in the coordinate system X_t-Y_t, one or more of the analytical drafting curves can be so oriented as to fit the plotted data to any desired degree of accuracy. In the drafting curves coordinate system X_r-Y_r, an exact mathematical expression or set of expressions for the plotted data is obtained. By use of the transformation equations that involve translation and, in general, rotation, the plotted data can be represented in the primary coordinate system X_t-Y_t. Therefore, the transformation equations (which are simple relations and are well known in mathematics) plus the mathematical equation of the drafting curve can by used analytically to represent all of the plotted data.

It has been found from actual tests with second degree curves that the aforementioned method can easily provide agreement between the plotted data and the mathematical equations of better than 99 percent (where the plotted data is accurate). Experimental data, of course, would be within the accuracy with which a smooth curve represented the actual values.

Tabulated data from solutions of high-order equations often cannot be conveniently subjected to "curve fitting" by computer. Such data in

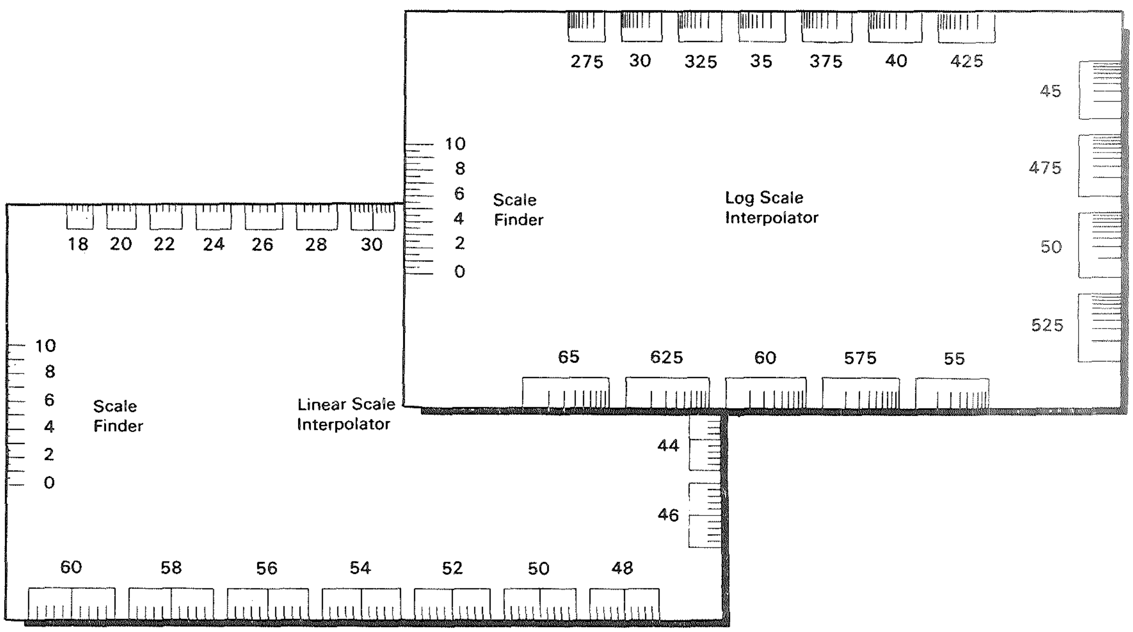
graphical form, however, can be conveniently represented by the analytical drafting curve method.

This method is most conveniently applied when the plotted data is single-valued in both coordinate systems. The use of analytical drafting curves can be applied to teaching analytic geometry, since two-dimensional coordinate transformation and curves that result from equations with multiple roots can be graphically demonstrated in a unique manner.

Source: Roger B. Stewart of
Langley Research Center
(LAR-90285)

Circle 15 on Reader's Service Card.

SIMPLE SCALE INTERPOLATOR AIDS IN READING GRAPHS



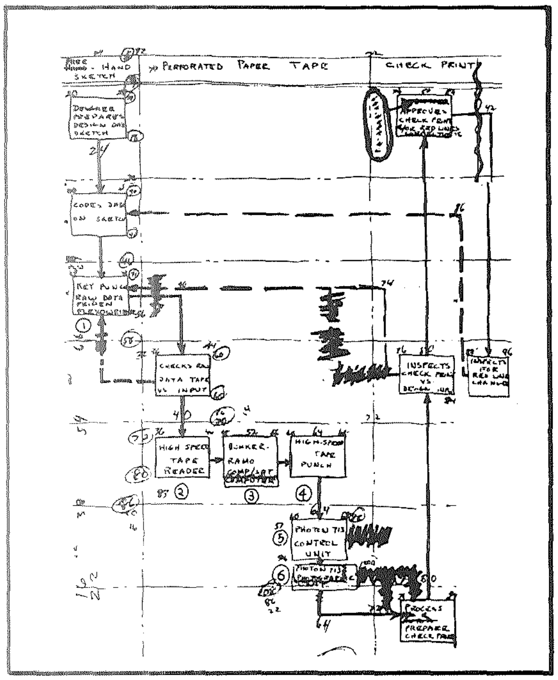
Sets of cards with scale divisions and a scale finder printed on the margins simplify reading graphs. One set is provided with a series of divided scales for interpolating linear plots, and another set is provided with a series of scales for logarithmic plots. A scale finder on the lefthand margin of each card, keyed to a code number near each scale, aids in the selection of the scale that will match the two coordinate divisions bounding the point to be read on the graph. The terminal lines on the proper scale are then made to coincide with the coordinate divisions on either side of the selected point on the graph, and the coordinate of the point can be rapidly read with respect to a subdivision on the full scale. For interpolation on linear plots, 34 different scales, with subdivisions ranging from 0 to 5 and 0 to 10, can be conveniently printed on both sides of a 3 x 5 in. card. For log plots, 28 single-cycle scales covering a range of log-cycle distances from 0.25 in. to 0.875 in. are printed on both sides of a 2-7/8 x 5 in. card. Larger cards are required for larger log-cycle distances.

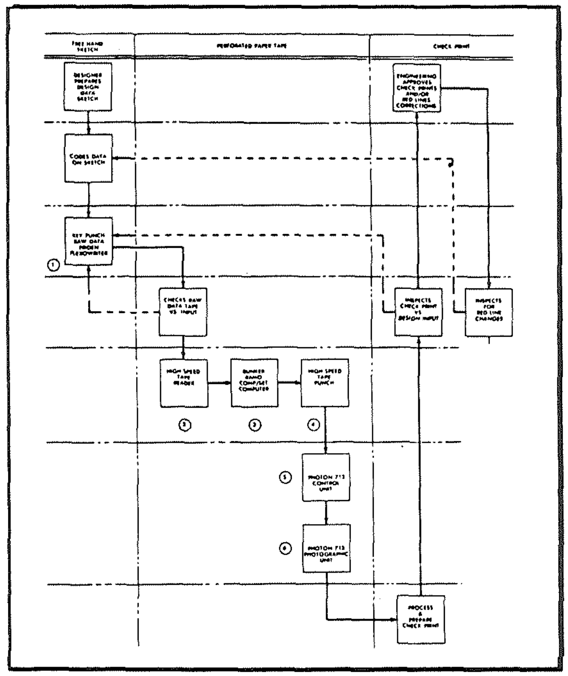
A related innovation is described in NASA Tech Brief B65-10070, March 1965.

Source: Anthony Fazio, Bert Henry, and
Dorothy Hood of
Lewis Research Center
(LEW-90092 & 90093)

Circle 16 on Reader's Service Card.

AUTOMATED DRAFTING SYSTEM USES COMPUTER TECHNIQUES





In implementing hardware production involving numerous complex items, large numbers of schematic and block diagrams must be produced from the design engineers' freehand sketches. Depending on complexity, a draftsman spends an average of 12 to 15 hours in producing a finished diagram. A system was devised that eliminates this excessive time which produces no essentially "new" information.

An automated drafting system has been developed that codes conventional drafting symbols and their coordinate locations on standard size drawings for entry on tapes used to drive a high speed photocomposition machine.

The designer's freehand sketch is marked with an alphameric code that translates the symbols, connecting lines, and coordinate locations into machine language. The coded data is converted into a raw data tape and typewritten text that can be checked for errors against the coded sketch. The raw data tape is fed to a computer that is programed to translate, arrange, and expand the raw data for transfer to a high speed output tape-perforating punch. The high speed punch converts computer impulses into holes in a paper tape that is fed into the control unit of a high speed photocomposition unit that responds to the pulsed instructions by photographically reproducing the diagram line by line and symbol by symbol in their prescribed coordinate locations. With this system, complex diagrams require only 3 to 4 hours including approximately 3 hours for translating the sketch information into machine language.

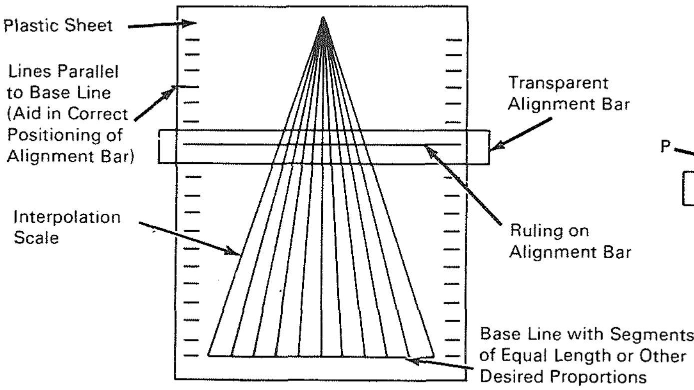
Source: Donald H. Millenson of
North American Rockwell Corp.
under contract to
Marshall Space Flight Center
(MFS-90788)

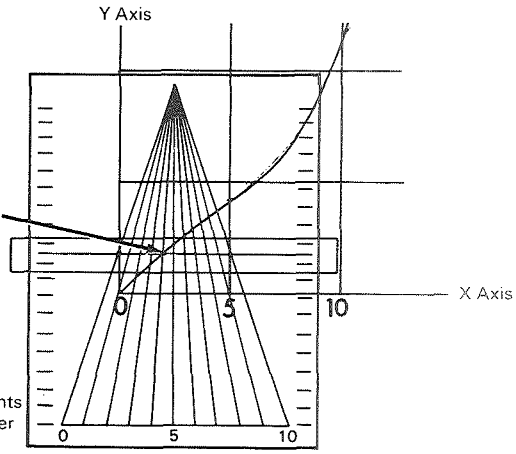
Circle 17 on Reader's Service Card.

SIMPLE SCALE INTERPOLATOR AIDS IN READING GRAPHS

Providing a simple device to facilitate accurate and rapid reading of the coordinates of points on graphs plotted on relatively coarse rectangular grids has been accomplished.

The device employs a transparent overlay with an interpolation scale that can easily be positioned





over a graph to permit accurate reading of the coordinates of any selected point.

The interpolation scale consists of a set of convergent straight lines inscribed on the underside of a transparent plastic or glass sheet. The segments at the base of the triangular interpolation scale must be of equal length for use with graphs plotted in Cartesian coordinates. For such use, the base line would generally be divided into ten equal segments. For graphs plotted in other rectangular coordinate systems (e.g., logarithmic or exponential plots), different proportioning of the segments on the base line would be required. The transparent sheet is mounted on a frame with a pair of parallel sides that form a track for a transparent alignment bar. A line parallel to the base line of the interpolation scale is inscribed on the underside of this bar.

The use of the device for reading a coordinate of a point on a curve plotted on a coarse Cartesian grid is illustrated in the second figure. To read the abscissa of the point P, for example, the graph is placed underneath the interpolation scale which is positioned so that the ruling on the alignment bar can be made to coincide with the X axis or a line parallel to this axis on the graph. The alignment bar is then slid along until the ruling intersects point P. Then while the alignment bar and graph are held steady, the interpolation scale is slid along the graph paper until the sides of the triangle (passing through 0 to 10 on the base line) respectively intersect the Y axis and one of the grid lines perpendicular to the X axis at division 5, for example, as shown in the illustration. In this position, the line segment (on the alignment bar) has an abscissa length of 5 units and is divided into 10 equal segments by the interpolation scale. Therefore each division has the value of 0.5 unit on the X axis, and the abscissa of P is read as 2 units. The ordinate of the point can be read by turning the graph at right angles to its original position and repeating the operation.

The device can be simplified by eliminating the alignment bar and frame and using only the triangular interpolation scale inscribed with a series of lines parallel to the base of the triangle.

It can also be modified to permit reading X and Y coordinates without rearranging the graph paper or for positioning near the corners of a book or journal.

Source: David E. Fetterman, Jr. of
Langley Research Center
(LAR-90088)

Circle 18 on Readers Service Card.

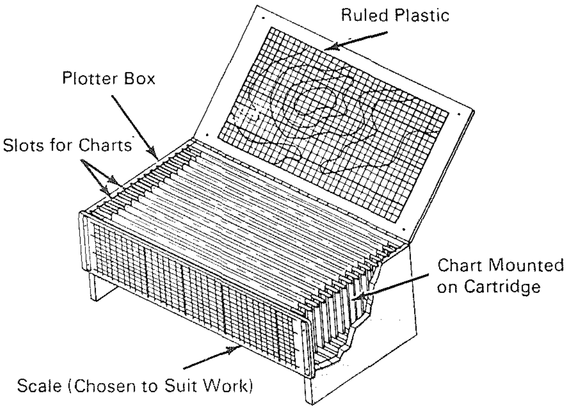
POLYCHART CONTOUR PLOTTER ENABLES DATA EXTRAPOLATION FROM MULTIPLE PLOTTING CHARTS

Antenna pattern charts are plotted as the antenna is rotated 360 degrees for each 10-degree increment the antenna is tilted from the vertical, or zero degree position. Because the antenna is tilted from zero to 180 degrees, the pattern is plotted on 19 separate charts. Reducing the data

to a one-chart form, using conventional overlay methods, has been a time-consuming task.

An inexpensive device, a polychart contour plotter, provides a means of reducing the data from 19 charts in a single simple operation.

Each chart is taped on a cartridge or spool so that the rotational coordinates lie along the length of the cartridge, and the power coordinates advance about the cartridge perimeter as it is turned. The charts on their cartridges are placed in the plotter and a sheet of thin, clear plastic is placed over them to provide a working surface. A contour-plot graph is placed on the sheet of clear plastic and secured by tape to prevent its moving. All the rectangular charts are aligned with the grid system of the contour-plot graph. The plotter may be used on any conventional light table or may be built with an appropriate light source in its base. All charts are rotated to the first indicated power level and one or more closed continuous lines are drawn on the contour-plot graph through points determined by the intersection of the curves on the rectangular charts with the top edges of the cartridges. To plot the

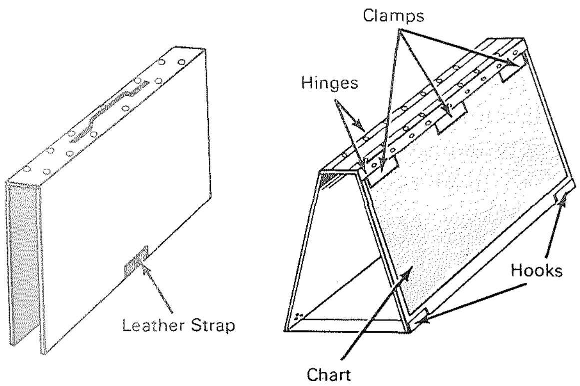


next contour line, all charts are advanced to the next indicated power level. A continuous plot is derived by extrapolation between the power levels transferred from the individual charts. The polychart contour plotter will be found useful in reducing a wide variety of data recorded incrementally on multiple charts.

Source: Paul M. Swindall and Thomas E. Wise of Marshall Space Flight Center (MFS-90037)

No further documentation is available.

CHART CASE OPENS TO FORM BRIEFING EASEL



A chart carrying case that will also serve as a briefing easel has been developed. The aluminum carrying case protects charts during transit and opens to form a rigid easel for easy presentation of the charts on display.

Two aluminum sheets hinged to an aluminum strip form a book-shaped assembly. Three triclip looseleaf clamps mounted inside the structure hold the charts, and a drawer pull fastened to the outside face of the strip provides a carrying handle. A leather strap fastened across the open end of the device locks it shut. For display, the strap may be unfastened and the two faces rotated 160° each, locking at the open end by two hinged hooks to form an inverted V-shaped easel. The charts are thus exposed for display and may be rearranged easily using the quick-action clamps.

Source: Ray A. Nelson of North American Rockwell Corp. under contract to Manned Spacecraft Center (MSC-90349)

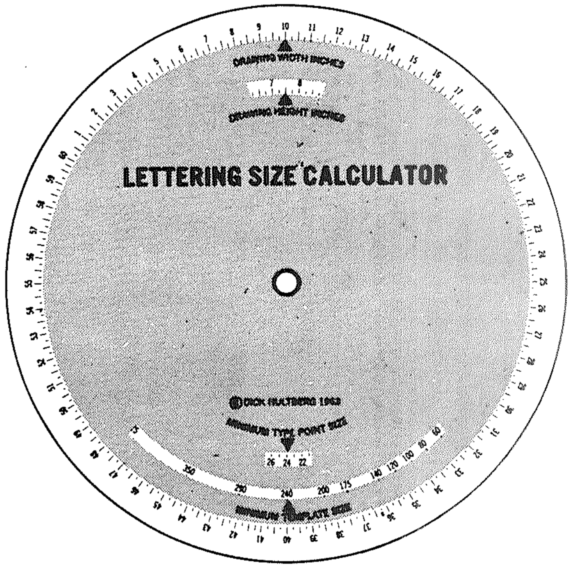
Circle 19 on Reader's Service Card.

DISK CALCULATOR INDICATES LEGIBLE LETTERING SIZE FOR SLIDE PROJECTION

A simple calculator has been constructed that indicates the minimum size of letters and numbers to be placed on a working drawing which is then to be made into a slide. It assures that the lettering size is adequate for legibility when the slide is projected on a screen.

The device is a hand-operated disk calculator designed to indicate minimum lettering size in relation to working-drawing width or height. The calculator consists of two pivoted concentric disks with numerical scales. The lower disk has four scales—one each for drawing width, drawing height, type size (in points), and lettering template size (in thousandths of an inch). The upper disk has openings through which the scales on the lower disk can be read. To determine the minimum letter size to be placed on the working drawing, the upper disk is rotated until a width or height arrow, for whichever dimension is going to be reduced by the greatest amount, is in line with the original drawing dimension on the lower scale. The minimum type size and lettering template size are then indicated by arrows on the upper disk pointing to numbers on the lower disk.

For example, if the original drawing has a working-area width of 10 inches and a working-area height of 7-1/2 inches or less (or a height of 7-1/2 and a width of 10 inches or less), the minimum letter size is 24 points (see illustration). These values will assure legibility when the drawing is reduced to a slide and projected.



The minimum letter size for the calculator was determined by trial and error in a medium-size auditorium. If the slides are projected in a conference room, the letter will be larger than necessary; if they are projected in a large auditorium, the letters might not be legible. An additional scale which indicates viewing distance or final projection size would make the device more versatile.

Source: Richard R. Hultberg of Goddard Space Flight Center (GSC-90409)

Circle 20 on Reader's Service Card.

NASA-Langley, 1971

FOR FURTHER INFORMATION

Use attached Reader Service Card. Circle key numbers to identify items for which additional information is desired, and mail.

OTHER TECHNOLOGY UTILIZATION PUBLICATIONS

These describe technology, derived from NASA's activities, that may have utility in nonaerospace applications. Publications include: Tech Briefs, Surveys, Handbooks, Reports, Technical Notes, Conference Proceedings, Special Studies, and Selected Bibliographies. (Details on their availability may be obtained from the address on the reverse of this Card.)

NASA SP-5919 (01) GRAPHIC ARTS TECHNIQUES & EQUIPMENT

READER SERVICE CARD

Circle key number for additional information:

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20				

Company (Print) ____________________

Name ____________________ Position ____________________

Street ____________________ City ____________________

State ____________________ Zip ____________________

☐ Place my name on mailing list to receive future issues of NASA Compilations.

National Aeronautics and Space Administration
Washington, D.C. 20546
OFFICIAL BUSINESS

NASA Scientific and Technical Information Facility
P. O. Box 33
College Park, Maryland 20740

National Aeronautics and Space Administration
Washington, D. C. 20546

OFFICIAL BUSINESS

FIRST CLASS MAIL

POSTAGE AND FEES PAID
NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION

POSTMASTER: If Undeliverable (Section 158 Postal Manual) Do Not Return

---

"The aeronautical and space activities of the United States shall be conducted so as to contribute . . . to the expansion of human knowledge of phenomena in the atmosphere and space. The Administration shall provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."

—National Aeronautics and Space Act of 1958

NASA TECHNOLOGY UTILIZATION PUBLICATIONS

These describe science or technology derived from NASA's activities that may be of particular interest in commercial and other non-aerospace applications. Publications include:

TECH BRIEFS: Single-page descriptions of individual innovations, devices, methods, or concepts.

TECHNOLOGY SURVEYS: Selected surveys of NASA contributions to entire areas of technology.

OTHER TU PUBLICATIONS: These include handbooks, reports, conference proceedings, special studies, and selected bibliographies.

Details on the availability of these publications may be obtained from:

National Aeronautics and
Space Administration
Code KT
Washington, D.C. 20546

Technology Utilization publications are part of NASA's formal series of scientific and technical publications. Others include Technical Reports, Technical Notes, Technical Memorandums, Contractor Reports, Technical Translations, and Special Publications.

Details on their availability may be obtained from:

National Aeronautics and
Space Administration
Code KS
Washington, D.C. 20546

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Washington, D.C. 20546